UNITED STATES DISTRICT COURT

FOR THE NORTHERN DISTRICT OF CALIFORNIA

OAKLAND DIVISION

EPIC GAMES, INC.,	)	Case No. 4:20-cv-05640-YGR-TSH
	)	
Plaintiff, Counter-defendant,	)	**WRITTEN DIRECT TESTIMONY**
	)	**OF PETER E. ROSSI, PH.D.**
v.	)	
	)	The Honorable Yvonne Gonzalez Rogers
APPLE INC.,	)	
	)	Trial: May 3, 2021
Defendant, Counterclaimant.	)	
	)	**Ex. Expert 3**

REDACTED VERSION OF DOCUMENT SOUGHT TO BE SEALED

Qualifications

1.   I am the James A. Collins Chair in Management, Distinguished Professor of Marketing, Economics and Statistics at UCLA. I also hold a joint appointment at the Anderson School of Management and Department of Economics. I completed my Ph.D. in econometrics—the application of statistical methods to economics data—at the University of Chicago Graduate School of Business (now the Booth School of Business) in 1984. I have authored and/or edited four books and over 65 articles in peer-reviewed journals on economics, surveys, marketing and econometrics.

Introduction

2.   I submitted an expert report in this case on February 16, 2021, and an errata on March 17, 2021. I conducted a survey to elicit reactions of U.S. consumers to a permanent five percent increase in the price of in-app purchases and subscriptions when purchased from within iOS apps ("at-issue purchases"). The goal of the survey was to measure how consumers would react to a specific price change in their individual spending on at-issue purchases. I asked about a specific price increase for the at-issue purchases rather than an increase in the commission rate because consumers do not have visibility into the relationship between the commission rate charged to developers and the prices of the at-issue purchases. When I wrote my report, I understood that Dr. David Evans might rely on my survey results.

3.   This is my direct testimony as if I were in Court testifying in person, and is given under penalty of perjury.

Summary of Opinions

4.   The target population for my survey included (i) U.S. residents age 17 and older who (ii) use an iOS device and (iii) have made at-issue purchases through the Apple App Store in the most recent 30 days. *See* p. 3.

5.   Prior to administering the survey, I conducted extensive qualitative interviews and pre-testing to ensure that participants understood the survey language and that the survey worked properly. *See* pp. 4-5.

6.   The survey began with initial qualifying questions, including the Reliability Test discussed further below. *See* pp. 5-6. Qualifying participants were instructed to provide information from their iOS devices about their actual spending on at-issue purchases from the Apple App Store for the most recent 30 days (Q15). *See* pp. 6-9.

7.   I then presented respondents with a hypothetical scenario in which, starting 30 days ago, the Apple App Store increased the prices of these purchases by five percent, and nothing else changed. I next presented respondents with the total increased cost of their actual at-issue purchases from the most recent 30 days under the five percent price increase scenario. I asked respondents whether they would have made the same purchases given the increase or whether they would have spent less (and I provided a "not sure" response option) (Q16). *See* pp. 9-10. Those who answered Q16 with either "yes" or "no" (but not "not sure") are referred to as "Deciders".

WRITTEN DIRECT TESTIMONY
OF PETER E. ROSSI, PH.D.

CASE NO. 4:20-CV-05640-YGR-TSH

8.   Respondents who said they would have spent less were asked in Q17 what they would have done to spend less among the following options: reduce purchases and spending in the Apple App Store; shift some or all at-issue purchases to other existing non-iOS devices; shift some or all at-issue purchases to a new non-iOS device; or none of the above. *See* p. 11. Those same respondents were also asked to estimate how much less they would have spent (Q18). *See* pp. 11-12.

9.   Participants who in Q17 stated that they would have shifted some or all of their spending on at-issue purchases to a new non-iOS device were also asked to what type of device they would switch (Q19). *See* p. 13.

10.   It was necessary to present respondents with a hypothetical scenario because the scenario with a uniform price increase for all at-issue products does not exist in the real world. My survey was well-designed to ensure that the hypothetical scenario led respondents to report realistic long-run behaviors. *See* pp. 13-14.

11.   Of Deciders, 81 percent responded that their at-issue purchases would have remained the same if the associated prices had been five percent higher than they actually were (this group is referred to as "Stickers"), and 19 percent responded that they would have changed their purchases in response to the price increase (this latter group is referred to as "Decrementers"). *See* p. 14.

12.   Only 1.3 percent of Deciders stated they would have switched from their current iOS device (iPhone or iPad) to a non-iOS device in response to the price increase (this group of respondents is referred to as "Switchers"). *See* pp. 14-15.

13.   I computed an overall price elasticity of -2.19, which means that in response to a five percent price increase, respondents would reduce their at-issue purchases by around 11 percent. *See* pp. 15-16.

14.   I provide affirmative evidence of the representativeness of my sample, including comparing respondents' reported monthly spending to Apple's transaction data ("Apple Transaction Data"). *See* pp. 16-18. I also conducted sensitivity tests, which confirm that my results were robust to excluding respondents with atypical responses from the sample, such as respondents who took an unusually long time to complete the survey or reported unusually high spending. *See* pp. 18-19.

Target Population

15.   A target population is the segment of the population whose characteristics the survey is designed to represent. My survey was designed to elicit how iOS users would respond to a change in the price of at-issue purchases. Given this, my survey's target population was (i) U.S. residents age 17 and older who (ii) use an iOS device and (iii) have made at-issue purchases in the most recent 30 days. I focused on participants over 17 because they are likely to have control over their own spending decisions, which is important because the survey asks respondents how they would change their spending behavior in response to a hypothetical price increase.

WRITTEN DIRECT TESTIMONY
OF PETER E. ROSSI, PH.D.

CASE NO. 4:20-CV-05640-YGR-TSH

Questionnaire Design: Qualitative Interviews and Pre-Testing

16.   Prior to writing the survey instrument that was ultimately administered, I conducted extensive qualitative research and pre-testing, critical components of survey design that ensure that questions are clear to participants in the way that the survey intends and avoid inducing random error and/or biased responses.

17.   Before drafting any survey questions, I conducted 12 in-depth qualitative interviews to learn how consumers think about and describe making at-issue purchases. This step provided me with an understanding of how consumers think and talk about the concepts featured in the survey, enabling me to design the survey questions accordingly.

18.   I used this information to prepare a draft questionnaire. I then conducted an unstructured pre-test in which that draft was administered to a small group of respondents. In the unstructured pre-test, experienced moderators engaged respondents in conversation as they completed the survey. This step eliminated ambiguities in the language of the questions to ensure that respondents interpreted questions as I intended.

19.   Next, I conducted structured pre-tests in which the survey was administered to a small sample of respondents. The resulting data were analyzed to ensure that the survey was well-understood and operating properly, participants understood the instructions, the questions yielded reliable data and the survey could be completed in a reasonable amount of time.[1]

20.   The process of drafting a high-quality survey questionnaire is iterative; drafts are tested and revised to eliminate ambiguity and assess reliability of the survey responses. I made four main changes between the first draft of my survey and the final draft. Through this iterative process, I determined that I had sufficient information to support that the changes to the survey would be well-understood and would address the issues raised during the multiple stages of pre-testing.

- *First*, instead of having participants estimate how much they spent on at-issue purchases based on memory, I instructed them to review their actual purchase history on their iOS devices and report the exact amount they spent on at-issue purchases during the most recent 30 days. Prior to this change, participants did not reliably report the apps in which they made their at-issue purchases and the amounts spent on those purchases. For example, in a prior version of the survey that allowed respondents to use a search box to find relevant apps, respondents reported an unusual number of apps that appeared towards the top of the app list when just one letter was typed into the search box. The change also allowed me to provide participants a precise, rather than estimated, expenditure amount for their at-issue purchases, given the hypothetical price increase scenario in Q16.

---

[1] I included "Don't know/Unsure" and "Other" response options in my survey questions to reduce the potential for respondents to provide an answer when they were unsure. I also rotated options where appropriate to account for potential order effects.

- *Second*, I added a stringent Reliability Test (*infra* ¶23) to ensure that participants were in fact iOS users and that they were attentive and willing to follow instructions to provide information from their iOS devices when asked to report on their purchase histories.

- *Third*, in order to help participants interpret the hypothetical scenario accurately, I changed the scenario from a future 30-day period to the most recent 30-day period (*infra* ¶¶29-31). Pre-testing showed that it was difficult for participants to imagine their at-issue purchases in a vague time period that had not yet occurred, especially given the issue of "lumpy" purchases (such as annual subscription charges in the most recent 30 days that would not be repeated in the next month). Once I framed the hypothetical around the most recent 30 days, it was feasible to provide respondents with a concrete understanding of what the price change would mean for them in terms of increased expenditures.

- *Fourth*, I refined language in Q16, which asked participants how they would react to a hypothetical price increase in the most recent 30-day period. The original language in Q16 included the phrase "fewer purchases", which pre-testing showed to be ambiguous and confused participants. Q16 also was phrased using a double negative, which was awkward, so I adjusted it to remove the double negative and to use more affirmative language.

Survey Administration and Initial Screening Questions

21.   My survey was administered over the internet with invitations sent to members of four internet panels via a process designed to ensure that the inbound sample was representative of the U.S. population with regard to gender, age and U.S. Census region based on answers to standard demographic questions.

22.   To ensure objectivity, the survey research was conducted in a double-blind manner (*i.e.*, neither the survey programmers, the panel providers, nor survey respondents were told who sponsored the survey or its purpose). To be eligible for inclusion, participants had to answer that they were over 17, used an iOS device and made at least one at-issue purchase in the most recent 30 days.

23.   As shown in the screenshots of Q10 and Q11 below, I included a Reliability Test, which asked participants to identify which model iOS device they use and to check their phone settings and report the first two letters of the associated model number. The test was designed to exclude respondents who would not check their iOS devices for potentially unknown information.

This was important to ensure that the ultimate group of respondents could accurately check their purchase histories to record how much they spent on at-issue purchases later in the survey.

Q10

What is the Model Name of your iPhone?

Click here for how to find this on your device.

Select one... ⌄

Continue »

Q11

Enter the first two digits of the Model Number of your iPhone. Again, this information cannot be used to identify your specific device.

Click here for how to find this on your device.

☐ Don't know

Continue »

Source: PX2547.12, PX2547.14

24.   I also conducted representativeness tests, which I discuss below (*infra* ¶¶46-50), to ensure that the use of an internet panel and inclusion of the Reliability Test resulted in a sample of respondents who were representative of the iOS user population.

Data Collection Questions

25.   Respondents who qualified for the survey based on the screening questions and who answered the Reliability Test questions correctly were directed to the main survey.

26.   The first part of the main survey was designed to collect information on respondents' use of computers, gaming consoles and their iOS devices. For their iOS and Android devices, respondents were asked: (a) how long they have had their current device; (b) when they anticipated replacing it; and (c) how many times they have replaced their device in the past five years (Q14).

27.   The key data collection question asked respondents how much they had spent on at-issue purchases in the prior 30 days (Q15). To ensure accuracy, the survey instructed

respondents to review their purchase history on their iOS devices (rather than rely on recall alone). As shown in the two screenshots of Instructions to Q15 below, I provided step-by-step directions on: (i) how to find the purchase history on their iOS devices, and (ii) what types of purchases to include.[2]

Source: PX2547.27

---

[2] In an earlier version of the survey, I observed that respondents may have taken the sample app names as suggestions of apps to select from the app database, as evidenced by an overrepresentation the sample apps chosen by respondents. The images were blurred to address this concern.

Source: PX2547.28

28.   As shown in the screenshot of Q15 below, respondents were instructed to enter the amount spent on each at-issue purchase made during the prior 30 days. I chose 30 days because consumers often think about spending in monthly billing cycles and 30 days would provide a sufficient number of purchases for the analysis, while limiting demands on respondents in entering

purchase data. In contrast, a longer period (say 60 days) would increase those demands and could reduce respondents' willingness to provide thorough and accurate answers.

Q15

From your Purchase History, enter in any purchase amounts for IN-APP PURCHASES and SUBSCRIPTIONS during the past 30 days (so since Dec 31, 2020).

Enter the exact amount of each purchase (including the dollars and cents). Select the purchase type (In-App Purchase or Subscription).

Items labeled as "iOS App" should not be included.

Click here to review which purchases we are interested in.

Enter amount	Purchase Type
$	Select one...

☐ I have no payments for In-App Purchases or Subscriptions in past 30 days.

Continue »

Source: PX2547.30

Price Increase Scenario Questions

29.   Once respondents provided their spending on at-issue purchases, I presented them with a hypothetical scenario in which the Apple App Store increased the prices of all at-issue purchases by five percent. I then showed respondents how much they would have spent on their at-issue purchases in the Apple App Store in those 30 days if prices had been five percent higher. The price change scenario references the 30-day period to provide respondents with a concrete timeframe and spending amount as context for the price increase.

30.   As shown in the screenshot of Instructions to Q16 below, in addition to providing a meaningful context for the price increase, I told respondents that nothing else about the Apple App Store or the at-issue purchases had changed, and that prices for those purchases everywhere else (*e.g.*, the Google Play Store and websites) did not change. In other words, I provided respondents with essentially full (or perfect) information about this price increase scenario. In the real world, consumers would only learn about such a price increase over the long run—that is, it is unlikely that the Apple App Store would announce an increase in the commission rate in a way that even a sizable portion of customers would recognize the change. As a result, elasticities provided in this report should be regarded as long-run, rather than short-run. The scenario also specifically states that the price change was "starting 30 days ago", indicating a continuing price

change into the future. I also note that consumers' experiences in the real world condition them to believe that price increases are not temporary but persist.

Source: PX2547.34

31.   After the hypothetical scenario above was presented to respondents, they proceeded to Q16, which (as shown in the screenshots of Q16 below) presented the same hypothetical scenario and asked respondents whether they would have made the same at-issue purchases from the Apple App Store at the higher price.

Source: PX2547.35

32.   For respondents who stated that they would have made the same purchases (the first option) or that they were not sure (the third option), the survey was concluded.

33.   Respondents who said that they would *not* have made the same purchases were asked how they would have changed their purchases (Q17). As shown in the screenshot of Q17 below, they were presented with the following options, and could choose as many as applied: (i) reduce purchases and spending in the Apple App Store; (ii) shift some or all at-issue purchases to other existing devices (non-iOS devices); (iii) shift some or all at-issue purchases to a new device (non-iOS device); or (iv) none of the above.

34.   This question provided additional context for respondents with a reminder to take switching costs into account. The question stated: "In considering your response, keep in mind potential costs and time required to shift purchases to other devices. See more detail."[3] These switching cost instructions are conservative in the sense that I could only invoke generic consideration of switching costs in a survey and no specific examples were used. Thus, the survey results likely show a greater degree of switching than would actually take place in the real world.

Q17

What would you have done to spend less than $4.24 in the Apple App Store?

In considering your response, keep in mind potential costs and time required to shift purchases to other devices. See more detail.

(Check all that apply)

☐ Would have kept my IAP/subscription spending in the Apple App Store but spent less than $4.24

☐ Would have shifted some or all of my IAP/subscription spending to my other existing devices (not my iPhone)

☐ Would have shifted some or all of my IAP/subscription spending to a new device (not an iPhone or iPad)

☐ None of the above

Continue »

Source: PX2547.36

35.   After respondents answered Q17, they were asked how much less they would have spent on at-issue purchases, as shown in the screenshot of Q18 below. Q18 provided respondents

---

[3] Respondents were able to click on "See more detail", which provided further information: "For example, the cost of the new device and accessories, installing and/or repurchasing apps from a different app store, compatibility with other devices and learning how to use new features of the device and the apps." (PX2547.37.)

WRITTEN DIRECT TESTIMONY
OF PETER E. ROSSI, PH.D.

CASE NO. 4:20-CV-05640-YGR-TSH

with a recap of their actual spending in the most recent 30 days and showed how much a five percent increase would have increased their spending on their recent at-issue purchases.

Q18

To recap the situation:

Past 30 days
Total spending: $4.04

Situation
Price increase (5%): $0.20
Same purchases would be: $4.24

You told us that in this situation you would have spent less than $4.24.

Enter below your estimate of HOW MUCH LESS you would have spent. In making this estimate, be sure to think about how you would have changed your purchases.

$ [   ]

Continue »

Source: PX2547.38

36.   Respondents who indicated in Q17 that they would have switched some or all of their spending to a new device, were also asked about the new device to which they would have switched, as shown in the screenshot of Q19 below.

Source: PX2547.41

Survey Recap

37.   In sum, the purpose of this survey was to measure how respondents would alter their spending behavior in response to a hypothetical five percent increase in the price of at-issue products. It is often necessary to ask consumers what they would do in hypothetical situations when those situations cannot easily be implemented and tested in the real world. While price changes are common in the real world, I am not aware of any event that could even approximate the uniform price increase of all at-issue products.

38.   Surveys that ask respondents questions about what they would have done in a hypothetical situation can provide reliable indicators of actual behavior when the survey is well-designed and carefully implemented. At least five elements of my survey support the reliability of its results. *First*, my extensive pre-testing ensured that participants understood the survey questions, including the hypothetical scenario (*supra* ¶¶16-20). *Second*, I provided a concrete contextualization of the hypothetical scenario, with information relevant to respondents (*supra* ¶30). *Third*, I confirmed the statistical reliability of the survey results (*infra* ¶45). *Fourth*, I provided affirmative evidence demonstrating that the survey population was representative of the

target population (*infra* ¶¶46-50). *Fifth*, I conducted several sensitivity tests and found that my results were robust to these tests (*infra* ¶51).

Results

39.   In total, 2,595 respondents completed the survey—I refer to these respondents as "Completers". Completers reported positive spending on at-issue purchases in the most recent 30 days and answered at least up to Q16, which asked how they would have responded to a five percent increase in the price of their at-issue purchases.

40.   Of the Completers, 10 percent (257 respondents) said that they were unsure if they would have changed their purchases/spending behavior in response to Q16. When I exclude this 10 percent of Completers, I am left with "Deciders" (2,338 respondents).

41.   As shown in Figure 1, among Deciders, 81 percent (1,884 respondents) responded "Yes, I would have made the same purchases and spent $[spending amount adjusted for 5% price increase]"—as noted above, I refer to this group as "Stickers". The other 19 percent (454 respondents) responded "No, I would have changed my purchases and spent less than $[spending amount adjusted for 5% price increase]"—as noted above, I refer to this group as "Decrementers".

Figure 1: Most Deciders Were Stickers
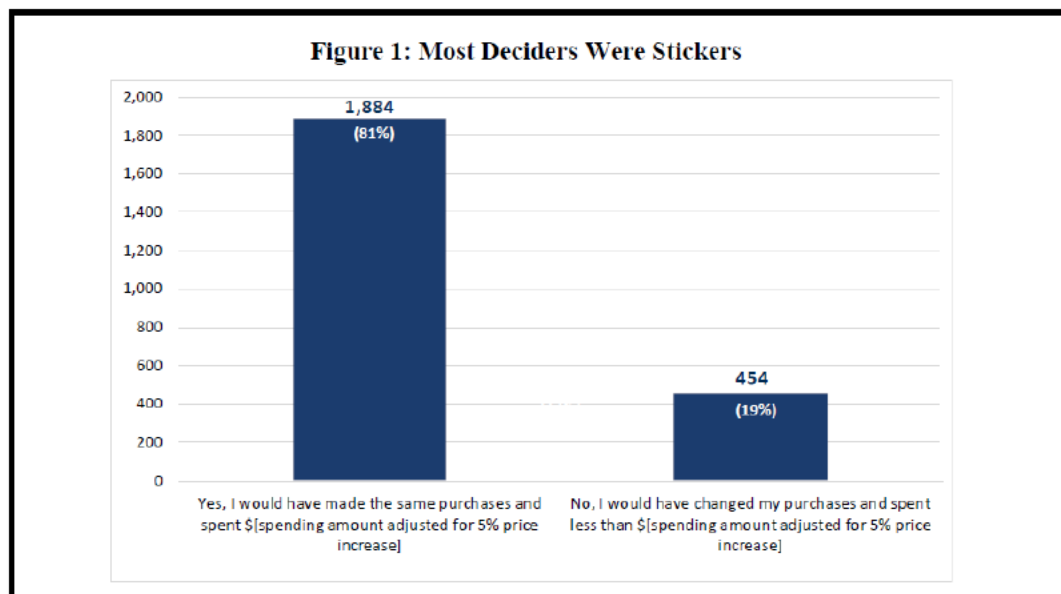
Source: PX1088.1 (summarizing PX2545)

42.   Among Decrementers, most would have kept some or all of their expenditures on iOS devices. Unlike Stickers, who completed the survey at Q16 (the hypothetical scenario), Decrementers proceeded to Q17, Q18 and, in some cases, Q19.

43.   Q17 asked Decrementers what they would have done to spend less (*supra* ¶33). Among Decrementers, 2.3 percent (53 respondents) would have shifted some or all their purchases to a new, non-iOS device. Those 53 respondents (iPhone or iPad users) were then asked to which type of device they would have switched their purchases, and could choose multiple answers (Q19). As depicted in Figure 2 below, of that group, 22 iPhone users (0.9 percent of Deciders)

WRITTEN DIRECT TESTIMONY
OF PETER E. ROSSI, PH.D.

CASE NO. 4:20-CV-05640-YGR-TSH

would have switched to a new phone (not an iPhone), and 13 iPad users (0.6 percent of Deciders) would have switched to a new tablet (not an iPad). Overall, only 30 respondents (1.3 percent of Deciders) would have made one or both of those switches.[4] As noted above, I refer to these 30 respondents as "Switchers" out of iOS; they are iOS device owners who stated that they would have shifted to a new non-iOS device of the same type (phone or tablet).

Figure 2: Switching Behavior
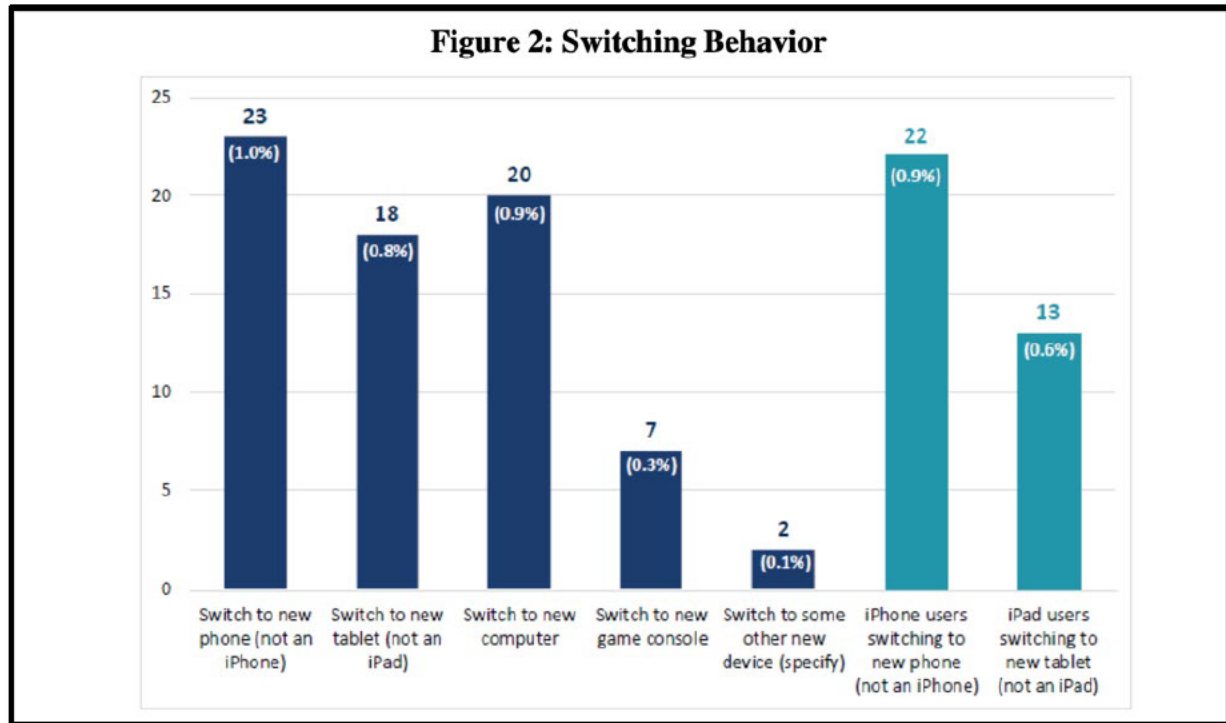
Source: PX1089.1 (summarizing PX2545)

44.   I also measured the demand elasticity for Deciders to check how sensitive respondent purchase *quantities* are to changes in their price. Demand elasticity measures the percentage change in the quantity of at-issue purchases caused by a one percent increase in their price.[5] As depicted in Figure 3 below, the elasticity is calculated as the percentage change in

---

[4] The 22 iPhone users and 13 iPad users are not mutually exclusive: Five respondents were both iPhone and iPad users and would have switched from both devices to non-iOS phones and tablets.

[5] The elasticity is calculated as

$$E = \left.[(Q_1 - Q_0)/Q_0]\middle/[(P_1 - P_0)/P_0]\right.$$
$$= \left.[(P_1Q_1 - P_1Q_0)/P_1Q_0]\middle/[(P_1 - P_0)/P_0]\right.$$

Where Q_0 and Q_1 are the purchase quantities before and after the price change, respectively, and P_0 and P_1 are the prices before and after the price change, respectively.

So: $E = \left.[\text{Spending Reduction})/\text{Initial Spending with 5\% price change}]\middle/5\%\ \text{Price Change}\right.$

spending in response to the price increase (relative to the value of the initial level of spending with the five percent increase) divided by the price increase (five percent). I calculated the elasticity as -2.19. This means that in response to a five percent price increase, respondents' at-issue purchases would decrease by around 11 percent. These elasticities should be regarded as long-run, rather than short-run, elasticities, for reasons that I discuss above (*supra* ¶30).

Figure 3: Elasticity Calculation			
	Stickers [A]	Decrementers [B]	Total [C]
[1] Total Initial Spending (Q15)	$66,907.6	$23,562.3	$90,469.9
[2] Total Initial Spending with 5% Price Increase	$70,253.0	$24,740.4	$94,993.4
[3] Spending Reduction (Q18)	$0.0	$9,596.7	$9,596.7
[4] Updated Spending	$70,253.0	$14,324.8	$84,577.7
[5] Price Increase	5%	5%	5%
[6] Elasticity (calculated as ([4] - [2])/[2]/[5])			-2.19

Source: PX1090.1 (summarizing PX2545)
Notes: Updated spending after 5% price increase. For Stickers, it is calculated as [2]-[3]. For Decrementers, it is calculated as [2]-[3], minus $819 with Switchers' spending set to $0.

45.   I confirmed the statistical reliability of my results by calculating confidence intervals for key statistics around the share of Stickers, the share of Switchers and the overall elasticity. I found that those confidence intervals were reasonably tight.

Quality of Data Collection (Representativeness)

46.   In order to ensure that survey results can be accurately extended to a given target population, the sample of survey respondents must be representative of that target population. At the onset of the survey, I made sure that the inbound sample—*i.e.*, the sample of respondents that first enters the survey—was representative of the U.S. population in terms of gender, age and Census region. To do this, I used a "click-balancing" process, by which the demographics of respondents who accept the survey invitation are continually tracked and further invitations are adjusted based on known demographic characteristics of survey participants.[6]

---

[6] Because I did not include education in the click-balancing exercise, I was able to use education as an independent variable to confirm the representativeness of the results at a later stage.

47.   I also conducted three comparisons to demonstrate that the sample of respondents who passed the Reliability Test was representative of the underlying target population of iOS device users who make at-issue purchases.

48.   *First*, I compared the data in my survey to data presented in an October 2020 analyst report from the investment bank, RBC Capital Markets.[7] This report, entitled "Apple Inc.", was prepared to inform potential investors in Apple about the market prospects of Apple products, entirely outside the context of this litigation. This report provided data on iPhone model and gender of iOS users that I compared to my survey sample. As demonstrated in Figure 4 below, I found that the distribution of iPhone models reported in my survey broadly matched the distribution presented in the RBC Capital Markets report, which suggests that both of these data sets are in fact representative of iOS users in the United States.[8] Indeed, it would be extremely improbable for two non-representative samples to align so closely. I found a similar match between the gender distribution at that stage of my survey and the gender distribution in the RBC Capital Markets report.

Figure 4: Distribution of iPhone Models

		RBC Survey		
Model [A]	Sample [B]	Share [C]	Lower 95% CI [D]	Upper 95% CI [E]
iPhone SE	4.3%	6%	3.9%	8.1%
iPhone 11 Pro Max	5.4%	9%	6.4%	11.6%
iPhone 11 Pro	4.6%	6%	3.9%	8.1%
iPhone 11	16.6%	17%	13.6%	20.4%
iPhone XS Max	3.5%	4%	2.2%	5.8%
iPhone XS	3.4%	3%	1.5%	4.5%
iPhone XR	14.7%	12%	9.1%	14.9%
iPhone X	4.9%	4%	2.2%	5.8%
iPhone 8	17.5%	15%	11.8%	18.2%
iPhone 7	14.1%	16%	12.7%	19.3%
Earlier iPhone	11.1%	8%	5.5%	10.5%

Source: PX1091.1 (summarizing PX2544)

49.   *Second*, the spending on at-issue purchases in my sample closely matched spending in the Apple Transaction Data. ███████████████████████████████

---

[7] Survey experts often rely on public market research such as this as a source of external data for benchmarking.

[8] Because the iPhone 12 model was not widely accessible to the public at the time of RBC's survey, I eliminated those respondents from my survey when comparing the two data sets.

██ (PX1085.1,
summarizing PX2306.1.)

50.   *Third*, my survey results were robust when re-weighted for level of educational attainment. My sample respondents had a relatively high level of educational attainment as compared to the Census population.[9] This finding alone does not indicate that my sample is non-representative; the Census measures pertain to the full adult U.S. population and arguably this is not the correct benchmark for assessing the representativeness of an internet panel (whose members, by definition, have internet access either via cellular or broadband service). To test whether these differences affect my results, I re-weighted respondents with lower levels of educational attainment (who were relatively underrepresented in my inbound sample) more heavily than respondents with higher levels, since the latter were relatively overrepresented in the inbound sample. As demonstrated in Figure 5 below, my results were robust to re-weighting.

	Figure 5: Reweight Sample on Education Based on 2019 U.S. Census Bureau Data						
	Reweighted on Education			Original Results			
Statistic	Observed	-95 CI	+95 CI	Observed	-95 CI	+95 CI	
[A]	[B]	[C]	[D]	[E]	[F]	[G]	
[1] Number of Deciders	2,066			2,338			
[2] Number of Stickers	1,650			1,884			
[3] Number of Switchers	25			30			
[4] Share of Stickers	79.9%	78.1%	81.6%	80.6%	79.0%	82.2%	
[5] Share of Switchers	1.2%	0.8%	1.7%	1.3%	0.9%	1.8%	
[6] Overall Elasticity	-2.26	-3.00	-1.65	-2.19	-2.85	-1.65	

Source: PX1092.1

Robustness Checks

51.   In addition to analyzing results for all Completers, I conducted three robustness tests to assess whether my results were robust when I excluded atypical groups of respondents from the sample.[10] *First*, I excluded respondents who took an unusually long amount of time to complete the survey (30 minutes, 45 minutes and one hour) and found the results were robust to these removals. *Second*, I excluded respondents who reported unusually high levels of spending on at-issue purchases and found the results were robust to these removals. *Third*, I excluded respondents with total subscription amounts equal to the monthly price of an iCloud subscription and no in-app purchases, under the assumption that these respondents might be less sensitive to a price increase. I found that the survey results were robust to removing participants whose total

---

[9] Survey experts frequently rely on public Census data for benchmarking purposes.

[10] Robustness testing analyzes the sensitivity of the results to the exclusion of these atypical respondents.

spending amounts on subscriptions were equal to the price of iCloud subscriptions at different price points (50 GB: $0.99; 200 GB: $2.99; 2 TB: $9.99).

* * *

Pursuant to 28 U.S.C. § 1746, I declare under penalty of perjury that the foregoing is true and correct and that I executed this written direct testimony on April 20, 2021, in Los Angeles, CA.

WORD COUNT: 4596

_____

Peter E. Rossi